

A REVISION OF THE FAMILY EPICRIIDAE  
(ACARINA—MESOSTIGMATA)

BY  
G. OWEN EVANS

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## CONTENTS

	<i>Page</i>
INTRODUCTION . . . . .	171
CLASSIFICATION . . . . .	173
Genus <i>Epicrius</i> Can. & Fanz. . . . .	174
<i>Epicrius mollis</i> (Kramer) . . . . .	175
<i>Epicrius canestrinii</i> Haller . . . . .	183
<i>Epicrius menzeli</i> Schweizer . . . . .	185
<i>Epicrius minor</i> Willmann . . . . .	188
<i>Epicrius spinituberculatus</i> n.sp. . . . .	188
<i>Species Dubiae</i> . . . . .	191
Genus <i>Berlesiana</i> Turk . . . . .	192
<i>Berlesiana cirratus</i> (Berl.) . . . . .	193
<i>Berlesiana denticulata</i> n.sp. . . . .	193
GEOGRAPHICAL DISTRIBUTION OF THE EPICRIIDAE . . . . .	196
DISCUSSION . . . . .	196
SUMMARY . . . . .	198
ACKNOWLEDGMENTS . . . . .	198
REFERENCES . . . . .	198

## INTRODUCTION

THE family *Epicriidae* Berl. comprises a small group of Mesostigmatid mites readily distinguished in the adult stage by the polygonal network of bi- or tri-urcate tubercles on the dorsal shield and the absence of an ambulacral apparatus on the first pair of ambulatory appendages. This characteristic ornamentation of the dorsum ("seriebus papillarum fuscarum symmetrice reticulato") was first described as occurring in *Gamasus reticulatus* Grube, 1859, but unfortunately the original description is inadequate for the recognition of its specific identity. In 1877 Canestrini & Fanzago figured a species for which they proposed the name *Epicrius geometricus*, thereby also erecting the new genus *Epicrius*. Later, Canestrini (1885) added a short description of the species. In the meantime, Haller (1881) had given a definition of *Epicrius* and added two other species to it, *Gamasus mollis* Kramer, 1876 and *Epicrius canestrinii* Haller, 1881. His description and figures of the latter are sufficiently detailed for recognition of the species.

Berlese (1886-87) in "Acari, Myriopoda et Scorpiones hucusque in Italia reperta" re-described and figured *E. geometricus* stating that it was found "in totius Italiae muscis, praecipue in montibus." In the same work *E. canestrinii* is referred to as a

variety of *geometricus*. Four other species, *Epicrius corniger* Berl., *Epicrius glaber* Berl., *Epicrius laelaptoides* Berl. and *Epicrius mollis* (Kramer) Berl. were also considered to be congeneric with *E. geometricus*. Later, Berlese (1916a) emended his concept of the genus *Epicrius* and transferred *corniger*, *glaber* and *laelaptoides* to the genus *Lasioseius* s. lat., and *mollis* to the genus *Epicriopsis* Berl. Further, in Berlese (1916b) *Gamasus mollis* Kramer 1876 non Berl., 1887 was considered to be the nymphal stage of *E. geometricus* which therefore falls into synonymy. Three new species of *Epicrius* were also described in this paper, namely, *E. cirratus*, *E. washingtonianus* and *E. parisiensis*. The latter was made the type of a new subgenus *Diepicrius*.

Absolon (1899) erected the genus *Eugamasus* (preoccupied by *Eugamasus* Berl., 1893) for *Eugamasus cavernarum* Absolon found on the excretory material of bats in a cave in Moravia. There is no doubt that this species is an Epicriid, probably of the genus *Epicrius*. It does not appear to have been found subsequently.

George (1906) re-described three species of *Epicrius* from Lincolnshire. The species he identified as *Epicrius mollis* (Kramer) is *Epicriopsis horridus* (Kramer) and what he believed to be *Epicrius canestrinii* has recently been given the new name *Cornubia georgei* by Turk (1943). The specimens of the third species are in the collections of the British Museum (Natural History) and are correctly determined as *Epicrius geometricus* Can. & Fanz. (= *E. mollis*).

Schweizer (1922) listed two species of the genus *Epicrius* from Switzerland, *E. geometricus* and *Epicrius menzeli* Schweizer, 1922. The specimens of the former were collected from three main regions, namely, "Mittelland," "Jura" and "Alpen". The females described from "Mittelland" and "Alpen" were correctly determined, but the female described and figured from the "Jura" was, as will be shown below, *Epicrius canestrinii* Haller.

Trägårdh (1942) in his revision of the genus *Epicrius* unfortunately deals only with *E. mollis*. This paper is important for the historical account of the genus and the description of the larva and the protonymph of the genotype. In addition, Trägårdh has dealt with the classification of the family *Epicriidae* in several papers on the comparative morphology of the Mesostigmata e.g. Trägårdh 1938, 1946a & b.

Turk (1943) has also added to our knowledge of the *Epicriidae* in his work on the British species. He erected a new genus, *Berlesiana*, for *Epicrius cirratus* Berl. on the basis of the structure of the sternal region in the female. The genus *Cornubia*, which was also proposed in this paper, was later made a synonym of *Ameroseius* Berl. (Turk, 1953). Two species are included in the genus *Epicrius*, namely, *E. mollis* and *E. geometricus*. His *E. mollis*, however, is *Epicriopsis horridus* (Kramer) and this invalidates the discussion in that paper on the synonymy of *E. mollis* and *E. geometricus*.

The most recent work on the genus *Epicrius* is by Willmann (1953). A new sub-genus, *Epicriella*, was proposed for *Epicrius (Epicriella) minor* Willm.

The object of the present work is to review our knowledge of the classification of the *Epicriidae* and to re-describe and figure, when possible, the known species. This revision is based on material in the collections of the British Museum (Natural History), the Oudemans Collection at Leiden and Dr. Jos. Schweizer's Collection at

Basle. Dr. G. Lombardini has also kindly undertaken comparisons of specimens of two species with the types in the Berlese Collection at Florence.

#### CLASSIFICATION

The supra-generic classification used in this paper follows that given by Evans (1955) in which the *Epicriina* was divided into two super-families, the *Epicrioidea* and *Zerconoidea*.

#### MESOSTIGMATA—EPICRIINA

“Mites with the epigynal portion of the genital plate in the female reduced to a narrow chitinized rim overlapping the genital orifice. Male genital opening situated in the sternal shield in the region of coxae II and III and closed by two plates, the anterior of which bears a pair of hairs. Chelicerae dentate in both sexes but without spermatophoral process in the male. Pedipalps with five free segments, specialized seta on palptarsus two or three pronged” (Evans, 1955).

#### Super-family EPICRIOIDEA Evans

*Epicrioidea* Evans, G. O. Bull. Brit. Mus. (nat. Hist.) 1954, Zool. 2 : 295.

Dorsal shield in both sexes provided with bi- or trifurcate tubercles forming a polygonal network, and a pair of large dorso-lateral protuberances of unknown function. Dorsal setae simple, setose or strongly barbed. Both sexes with jugularia; sternal setae II and/or IV may be situated on a sclerotised shield or on the inter-scutal membrane. Geniti-ventral shield in the female large, flask-shaped or rectangular. Sterniti-genital shield in the male extending posterior to coxae IV. Gnathosoma with four pairs of ventral setae; corniculi short, digitiform. Pedipalps with the tibia and tarsus fused dorsally. Specialized seta on palp tarsus three-pronged. Peritreme markedly reduced or absent. Stigmata enclosed in the lateral extension of the dorsal shield. Leg I without ambulacral apparatus. Tarsus I (and sometimes tibia I) with specialized, clubbed sensory setae. Legs II–IV with multi-lobed pulvillus and two claws.

#### Family EPICRIIDAE Berl.

*Epicriidae* Berlese, A. Bull. Soc. ent. Ital. 1885, 17 : 129.

The only family of the *Epicrioidea* and therefore with the above characters. The *Epicriidae* consists of two genera which may be distinguished as follows:

1. The majority of the dorsal setae more than 100 $\mu$  in length, simple or setose. Dorso-lateral protuberances large, conspicuous. Tarsus I with three or more clubbed sensory setae . . . . . *Epicrius* Berl.
- . The majority of the dorsal setae less than 60 $\mu$  in length, stout and strongly barbed (fig. 32). Dorso-lateral protuberance small, inconspicuous. Tarsus I with less than three pairs of clubbed sensory setae . . . *Berlesiana* Turk

I. Genus *Epicrius* Canestrini & Fanzago

*Epicrius* Canestrini, G. & Fanzago, F., Atti. Ist. Venet. 1877, (5) 4 pt. 1 : 131.

*Eugamasus* Absolon, Ph. C. K., Zool. Anz. 1899, 22 : 324.

*Parasejus* Trägårdh, T. Naturw. Untersuch. des. Sarekgebirges. 1910, 4, 4 : 432.

*Epicrius* (*Diepicrius*) Berlese, A., Redia, 1916, 12 : 151.

*Epicrius* (*Epicriella*) Willmann, C., Sitzber. österr. Akad. Wiss. math-nat. Kl. 1953, 1, 6 : 474.

Dorsal setae simple or setose; the majority longer than  $100\mu$ . Dorso-lateral protuberance large. Geniti-ventral shield flask-shaped. Tarsus I with three or more clubbed setae. Other characters as in the definition of the super-family.

Type : *Epicrius geometricus* Can. & Fanz., 1877, (= *Gamasus mollis* Kramer, 1876).

This genus contains five species which may be considered valid and three species of uncertain status pending the re-examination of the type material. The former may be separated according to the following key to both sexes :

*Key to the species of the genus Epicrius Can. & Fanz., 1877**Females.*

1. Sternal setae II situated on the interscutal membrane between the jugularia and a shield bearing sternal setae III and IV . . . . . *Epicrius minor* Willmann
- . Sternal setae II situated on a well-sclerotised shield with setae III or setae III and IV . . . . . 2.
2. Dorsal setae D<sub>2</sub> and D<sub>4</sub> about one-third the length of setae D<sub>3</sub> . . . . . 3.
- . Dorsal setae D<sub>2</sub> to D<sub>4</sub> approximately equal in length. Sternal setae II to IV on an undivided shield. Interscutal membrane between geniti-ventral and anal shields with seven setae . . . . . *Epicrius menzeli* Schweizer
3. Projections of dorsal tubercles with rounded extremities (Pl. 1) . . . . . 4.
- . Projections of dorsal tubercles sharply pointed at their extremities (Pl. 2). Sternal setae II to IV on an undivided shield. Interscutal membrane between geniti-ventral and anal shields with four setae. Anal shield with the usual three setae  
*Epicrius spinituberculatus* sp. n.
4. The seta posterior to the large dorso-lateral protuberance separated from it by a transverse row of tubercles. Sternal setae II to IV on an undivided shield. The four setae between the genitiventral and anal shields each situated on a platelet<sup>1</sup>  
*Epicrius canestrinii* Haller
- . The seta posterior to the large dorso-lateral protuberance not separated from it by a row of tubercles. Sternal setae IV (metasternals) separated from shield bearing setae II and III. The pair of setae between the geniti-ventral and anal shields not on platelets . . . . . *Epicrius mollis* (Kramer) Berl.

*Males.*

1. Anal shield completely fused with the dorsal shield. Posterior margin of the sterniti-genital shield strongly convex. With three pairs of setae on the interscutal membrane posterior to the sterniti-genital shield . . . . . *Epicrius mollis* (Kramer) Berl.
- . Anal shield free, or partly fused with the dorsal shield. Posterior margin of the sterniti-genital shield truncated . . . . . 2.

<sup>1</sup> In some specimens the platelets on one side of the mid-ventral line may be fused so that there are only three platelets between the geniti-ventral and anal shields, (see p. 13).

2. Setae D<sub>2</sub> and D<sub>4</sub> about one-third the length of setae D<sub>3</sub> . . . . . 3.  
 -. Setae D<sub>2</sub> to D<sub>4</sub> approximately equal in length. Ventri-anal shield with ten pre-anal setae . . . . . *Epicrius menzeli* Schweizer  
 3. Projections of dorsal tubercles rounded at their extremities. Region between the sterniti-genital and anal shields occupied by a large rectangular shield bearing three pairs of setae . . . . . *Epicrius canestrinii* Haller  
 -. Projections of dorsal tubercles sharply pointed. With a ventri-anal bearing three pairs of pre-anal setae . . . . . *Epicrius spinituberculatus* sp. n.

*Epicrius mollis* (Kramer), 1876.

*Gamasus mollis* Kramer, P. Arch. Naturgesch. 1876, 42: 82 (fig.); Berlese, A., Redia, 1916, 12: 150. *Epicrius mollis*, Trägårdh, I., Ark. Zool. 1942, 34A (4): 3 (fig.).

*Epicrius geometricus* Canestrini, G. & Fanzago, F. Atti Ist. Venet. 1877, 1: 60; Haller, G. Arch. Naturgesch. 1881, 47: 190; Canestrini, G. Prosp. Acarof. Ital. 1877, (5) 4: 131 (fig.); Berlese, A., A.M.S., Padova, 1886, 30: 8 (fig.); George, C. F., Naturalist, 1906: 265 (fig.).

The writer follows Berlese (1916) and Trägårdh (1942) in considering *G. mollis* to be the nymphal (deutonymphal) stage of *E. geometricus*. The two main objections to the acceptance of this synonymy are that Kramer's description and figure are not sufficiently detailed for the specific identity of the species and that the original figure of *mollis* shows only one pair of dorso-lateral protuberances whereas *geometricus* is figured with two pairs. It is probable, however, that Berlese examined the type material of *geometricus* before coming to any decision regarding the synonymy of the species so it is assumed that the original figure of *geometricus* is inaccurate. Berlese (1886) figured *geometricus* with one pair of dorso-lateral protuberances and certainly no Epicriid with two pairs of these structures has been described since Canestrini & Fanzago (1887).

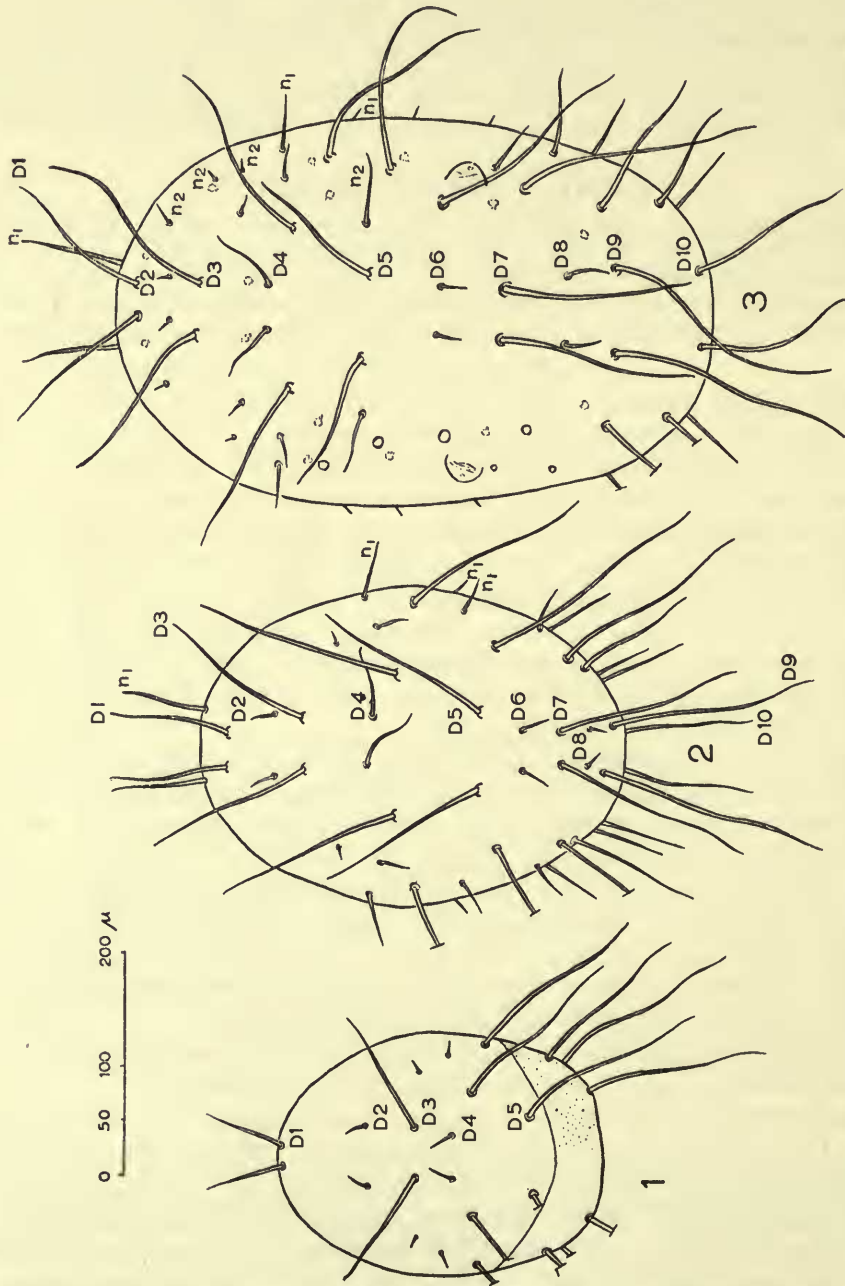
The following re-description of *E. mollis* is based on material collected over a period of twelve months from litter under a Spruce stand in South Bedfordshire.<sup>1</sup>

*Dorsal shield.* The dorsal surface of the larva is incompletely covered by a weakly sclerotized shield bearing nine pairs of setae distributed as in Text-fig. 1. These setae are probably homologous with those occurring on the anterior shield of the larvae of the free-living Laelaptoidea (Evans, 1953). The interscutal membrane posterior to the shield is granulated and bears three pairs of long whip-like setae. In the protonymph the dorsum is completely covered by a weakly sclerotized shield (Text-fig. 2). The chief features of interest in the chaetotaxy of the shield are:

- (1) the addition of five pairs of dorsal setae (D) making a total of ten pairs; and
- (2) the addition of setae n<sub>1</sub> in the anterior half of the shield.

The relative lengths of the setae D<sub>1</sub> to D<sub>5</sub> are approximately the same in both stages, i.e. D<sub>2</sub> and D<sub>4</sub> are considerably shorter than D<sub>1</sub>, and D<sub>3</sub>. Setae D<sub>6</sub> and D<sub>7</sub> in the protonymph are much shorter than D<sub>7</sub>, D<sub>9</sub> and D<sub>10</sub>. The writer has been unable to distinguish, with certainty, between larval and protonymphal setae in the posterior half of the shield. The sclerotized dorsum of the deutonymph is characterized by the development of a pair of large dorso-lateral protuberances (Text-fig. 3).

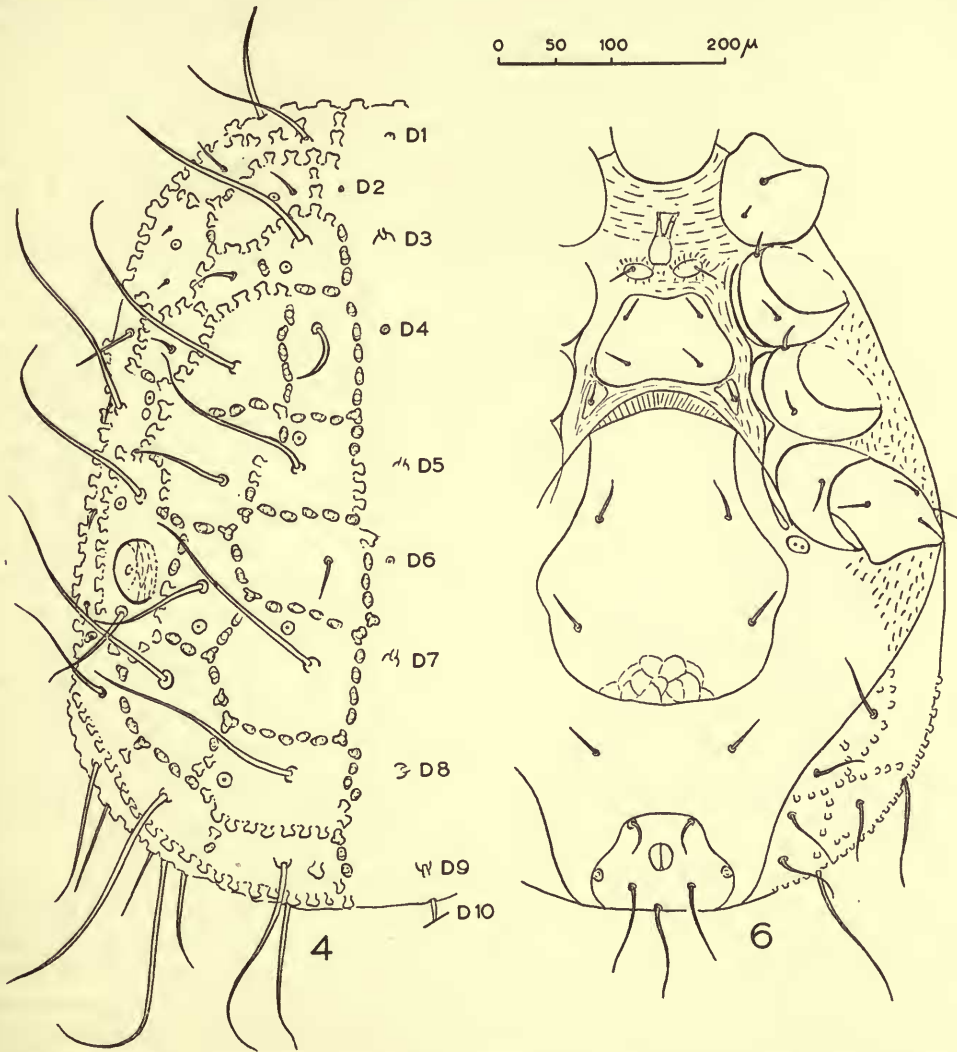
<sup>1</sup> Collected during investigations financed by H. M. Forestry Commission whilst the writer was on the staff of Rothamsted Experimental Station, Harpenden, Herts.



TEXT-FIGS. 1-3. *Epicrius mollis* (Kr.). Chaetotaxy of the dorsum of the larva (Fig. 1), protonymph (Fig. 2) and the deutonymph (Fig. 3). D, dorsal series; n1, protonymphal setae; n2, deutonymphal setae.



The relative lengths of the setae D1 to D10 are approximately the same as in the protonymph. The deutonymphal setae in the anterior half of the shield are indicated by the symbol n2. There is no increase in the number of setae on the dorsal shield



TEXT-FIGS. 4, 6. *Epicrius mollis* (Kr.). Fig. 4, dorsum of female. Fig. 6, venter of female. Abbreviations as Fig. 1.

from deutonymph to adult (Text-fig. 4). The dorsum of the adult (both sexes) is strongly sclerotized and characteristically ornamented. The ornamentation comprises bi- and trifurcate tubercles forming a polygonal network (Pl. 1). The dorsal setae are setose (Text-fig. 5). The chaetotactic pattern is shown in the figure. Setae D8 which are considerably shorter than D9 in the deutonymph are almost

equal in length to them in the adult. The inornate region surrounding the dorso-lateral protuberance carries two setae and a large pore-like structure.

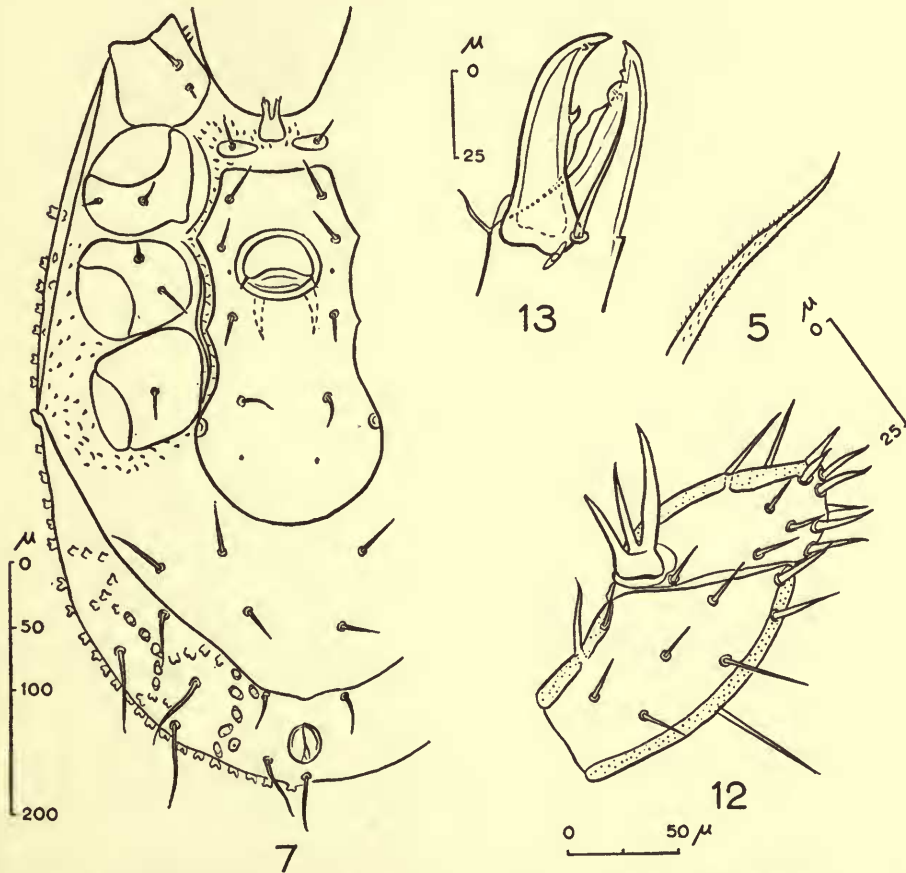
*Ventral shields.* The ventral surface of the larva is weakly sclerotized. The sternal shield, extending from the posterior margin of coxae I to the posterior margin of coxae III bears three pairs of simple setae. The oval anal shield is provided with a pair of para-anals and a post-anal seta. These setae are long and extend beyond the posterior margin of the body. The interscutal membrane posterior to coxae IV has four pairs of setae of which two pairs are situated between the sternal and anal shields. The sternal and anal region in the protonymph is similar to that in the preceding stage. The region between the sternal and anal shields is provided with three pairs of setae. The sternal shield in the deutonymph bears four pairs of setae and is more strongly sclerotized than in the larva and protonymph. The anal shield has three long setae.

The venter of the female is shown in Text-fig. 6. The first pair of sternal setae are situated on small platelets (jugularia) surrounded by striated membrane. Sternal setae II and III stand on a distinct shield situated between coxae II and III and the metasternals on separate shields postero-lateral to it. The separation of setae IV from the main sternal shield is difficult to detect in specimens not cleared in lactic acid. The sternal shield is not fused with the endopodals. The geniti-ventral shield is large and flask-shaped, and bears two pairs of setae. The epigynal portion of the shield is poorly developed being reduced to a narrow semi-transparent band along the anterior margin of the shield. The region between the geniti-ventral and the ventri-anal shields has a pair of simple setae. The ventri-anal bears a pair of pre-anals and para-anals, and a post-anal seta. The para-anals and the post-anal seta are situated behind the anal opening. There is a pair of conspicuous pore-like structures on the lateral margin of the shield. The remaining sclerotized structures of the venter are a bi-furcate tritosternum, a porose plate situated posterior to coxae IV and the ventro-lateral extension of the dorsal shield, which is provided with a network of tubercles and a number of setae. The interscutal membrane in the region of the jugularia and lateral to the coxae is richly provided with short spines.

The ventral surface of the male differs considerably from that in the female (Text-fig. 7). The jugularia are present in normal position, but the region between coxae II and IV is occupied by a well-sclerotized shield bearing four pairs of setae and three pairs of "pores." This shield, the sterniti-geniti-ventral, extends beyond the posterior margin of coxae IV. It is truncated anteriorly but strongly convex posteriorly. It is not fused with the endopodals. The male genital orifice is situated between coxae III and is covered by two plates. A pair of setae protrude from under the postero-lateral margin of the anterior plate. The ventri-anal shield is fused with dorsal shield, but the setae associated with the anal region are present in the same position as in the female. The interscutal membrane posterior to the sterniti-geniti-ventral shield carries three pairs of setae.

*Gnathosoma, pedipalps and chelicerae.* The ventral surface of the gnathosoma in the larva is provided with two pairs of setae, namely, the rostrals and the external posterior rostrals (Text-fig. 8). The corniculi are slender and digitiform. There are

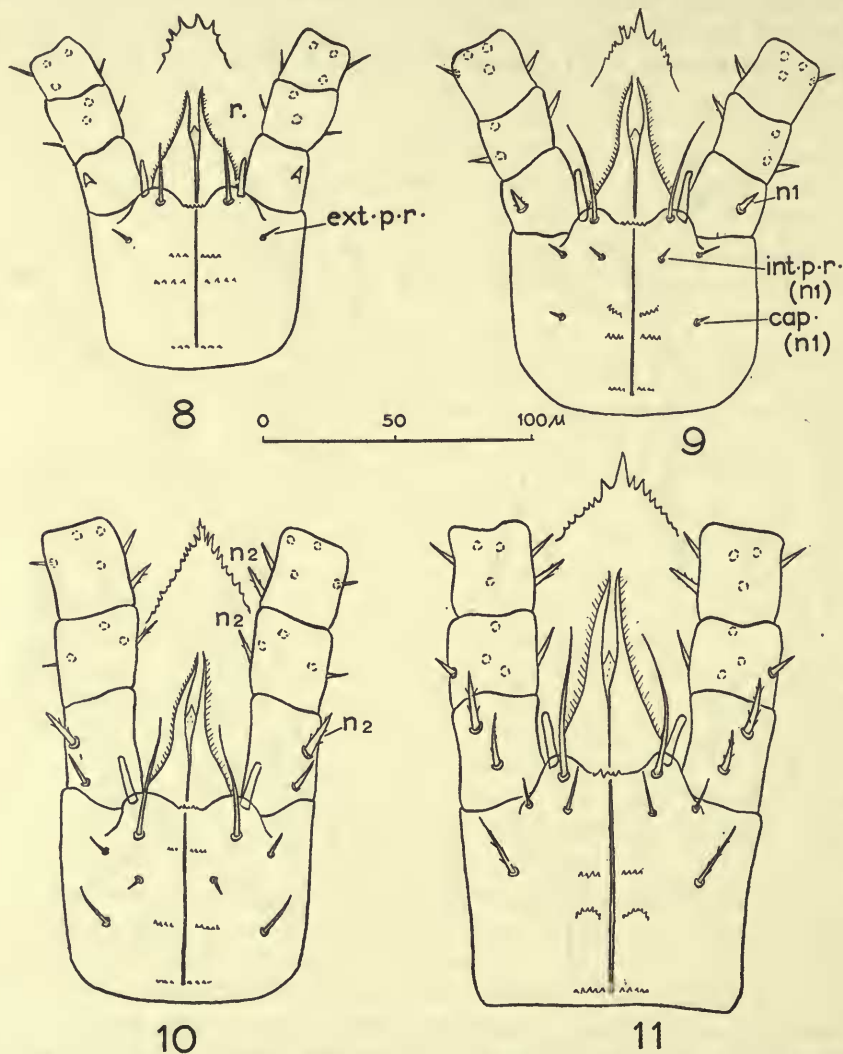
four rows of denticles in the region of the ventral groove. The pedipalps comprise five free segments. The palptibia and tarsus are divided by a distinct suture ventrally, but are fused dorsally. The specialized seta on the palptarsus is three-pronged. The palptrochanter has a spur-like projection ventro-laterally. The chaetotactic formula for the trochanter, femur and genu is (0-4-5). The ventral



TEXT-FIGS. 5, 7, 12, 13. *Epicrius mollis* (Kr.). Fig. 5, distal end of dorsal seta. Fig. 7, venter of male. Fig. 12, palptibia and tarsus (ventral) of female. Fig. 13, chelicera of female.

surface of the gnathosoma in the protonymph bears two additional pairs of setae—the internal posterior rostrals and the capitular setae (Text-fig. 9). The chaetotactic formula for the palptrochanter, femur and genu is (1-4-5). In the deutonymph there is a further increase in the number of setae on the pedipalp. These additional setae are indicated by the symbol  $n_2$  in Text-fig. 10. There is no change in the chaetotaxy of the pedipalp from deutonymph to adult (Text. fig. 11). The structure

of the venter of the palptibia and tarsus is shown in Text-fig. 12. These segments are fused dorsally. The development of the chaetotaxy of the gnathosoma and first



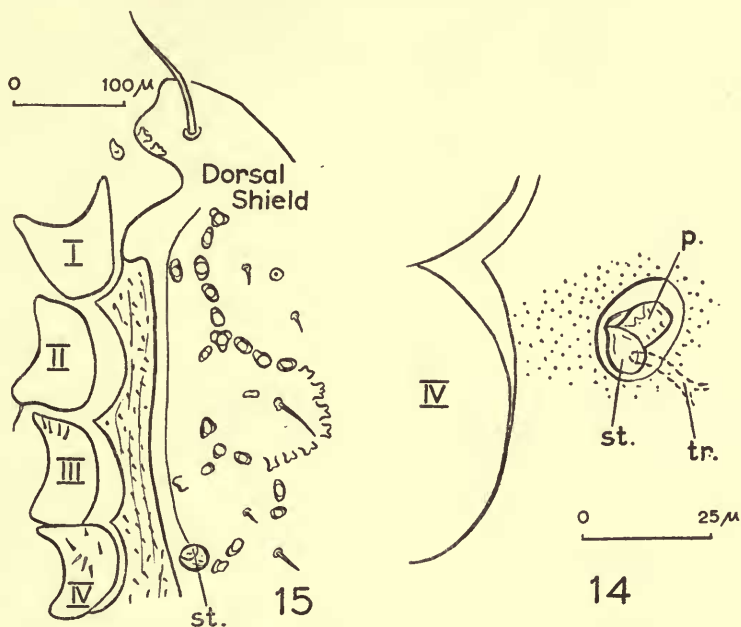
TEXT-FIGS. 8, 9, 10, 11. *Epicrius mollis* (Kr.). Gnathosoma (ventral) of larva (Fig. 8), protonymph (Fig. 9), deutonymph (Fig. 10) and female (Fig. 11). *r.*, rostral setae; *ext.p.r.*, external posterior rostral setae; *int.p.r.*, internal posterior rostral setae; *cap.*, capitular setae.

three free segments of the pedipalp in *Epicrius* is essentially similar to that described by Evans (1953) for the genus *Typhlodromus* Scheuten (*Gamasina—Laelaptoidea*).

The tectum in all stages is broadly triangular in shape and has a denticulate margin (Text-figs. 8–11). There appears to be considerable variation in the degree of denticulation, at least in the series examined.

The chelicerae are chelate-dentate. The dentition is weak in all stages. The structure of the chelicera of the female is shown in Text-fig. 13.

*Stigmata and peritremes.* The stigmata and peritremes are not developed in the larva. In the protonymph the stigma (*st*) is situated ventro-laterally in the region of the third intercoxal space (Text-fig. 14). The peritreme (*p*) is markedly reduced and is enclosed with the stigma in an oval depression of the body. The main tracheal branch is conspicuous. The stigma and peritreme is the same in the deutonymph.

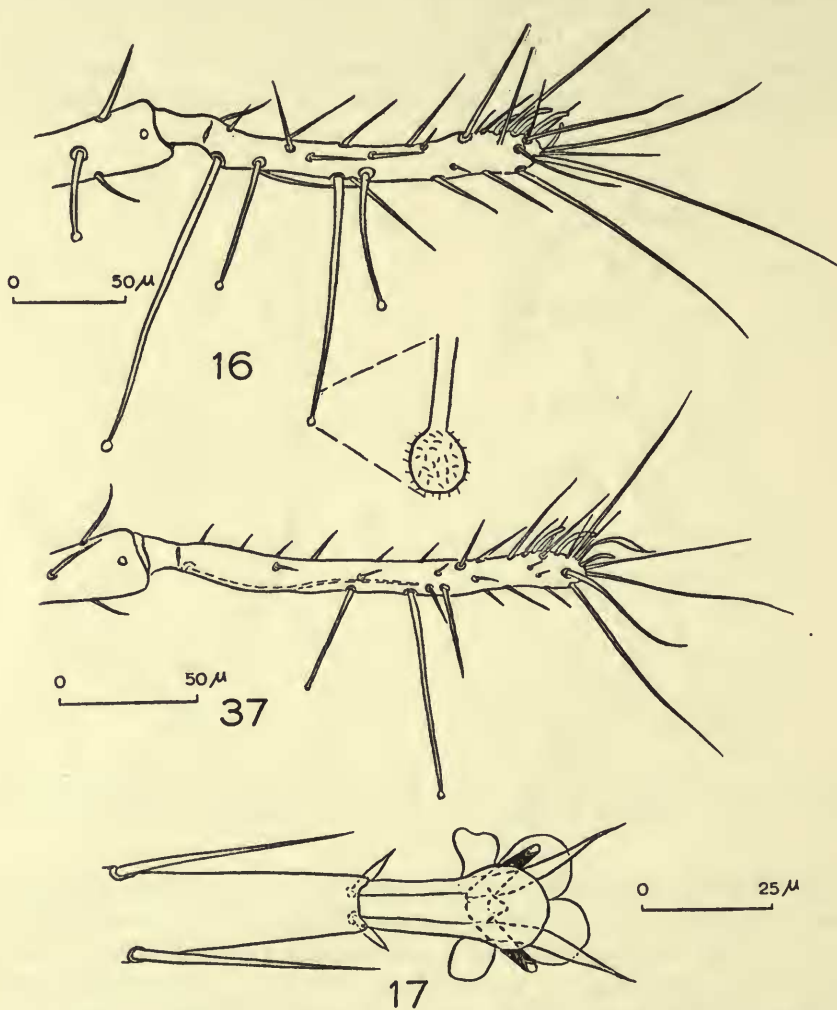


TEXT-FIGS. 14, 15. *Epicrius mollis* (Kr.). Fig. 14, stigmatal region of protonymph. Fig. 15, stigmatal region of female. *st.*, stigma; *p.*, peritreme; *tr.*, trachea.

In the adult, however, the stigma is enclosed in the heavily sclerotized lateral extension of the dorsal shield. The stigmal opening is situated on a small protuberance (Text-fig. 15). The only indication of a peritrematal plate (?) is the presence of a well-defined line running from the stigma to the level of coxa I and thereby separating a strip of smooth sclerotized plating from the ornamented dorsal shield.

*Legs.* All the legs comprise six free segments with the terminal segment incompletely separated into a metatarsus and tarsus. Leg I is the longest in all stages and the tarsus is without an ambulacral apparatus. In the adult, tibia and tarsus I are provided with specialized sensory (?) setae ventro-laterally (Text-fig. 16). These long setae, of which there is one on the tibia and four on the tarsus, are club-like distally. The swollen head of the seta is minutely setose. The number and position of these setae are different in the species examined, but since the majority of the specimens were poorly preserved—the distal end of the setae are easily broken off in prepared specimens—full use could not be made of this character. The remaining

ambulatory appendages terminate in a multi-lobed pulvillus and two claws (Text-fig. 17). The majority of the setae on the femur to tibia are stout and spinose, and stand on distinct bases.



TEXT-FIGS. 16, 17. *Epicrius mollis* (Kr.). Fig. 16, Tibia and tarsus I. Fig. 17, Ambulacral apparatus of Leg. II.

TEXT-FIG. 37. *Berlesiana denticulata* sp. n. Tarsus I.

#### DIMENSIONS.

*Larva*, 265–280 $\mu$  in length and 195–200 $\mu$  in breadth.

*Protonymph*, 310–340 $\mu$  in length and 245–250 $\mu$  in breadth.

*Deutonymph*, 440–490 $\mu$  in length and 305–335 $\mu$  in breadth.

*Female*, 640–660 $\mu$  in length and 405–410 $\mu$  in breadth.

*Male*, 570–600 $\mu$  in length and 360–370 $\mu$  in breadth.

*Locality.* This species is the most abundant and widely distributed of the genus. It has been recorded from moss and forest litter in Italy, Austria, Switzerland, Germany, Holland, Sweden and the British Isles.

*Epicrius canestrinii* Haller, 1881

*Epicrius canestrinii* Haller, G., Arch. Naturgesch. 1881, 47: 191 (fig.); Oudemans, A. C., Zool. Anz. 1939, 126: 307.

*Epicrius (Diepicrius) parisiensis* Berlese, A., Redia, 1916,<sup>1</sup> 12: 152, *syn. nov.*

*Epicrius geometricus*, Schweizer, J. Verh. Natf. Ges. Basel, 1922, 33: 46 ♀.

The following re-description of *E. canestrinii* is based on specimens of both sexes in the British Museum (Nat. Hist). — from the Michael Collection. The specimens are mounted in Canada Balsam.

*Female.* The dorsal shield, about  $500\mu$  in length and  $350\mu$  in breadth, shows the normal network of tubercles. The latter are bi- or trispinate; the projections having rounded extremities. The dorsal chaetotaxy is shown in Text fig. 18. Setae D<sub>2</sub> and D<sub>4</sub> are considerably shorter than setae D<sub>3</sub>, but setae D<sub>7</sub>, D<sub>8</sub> and D<sub>9</sub> are approximately equal in length. The dorso-lateral protuberance is well-developed and broadly triangular in shape. The ornamentation in the region of the protuberance differs from that in the other species of the genus examined by the writer. The anterior tubercle seta and the dorso-lateral protuberance are distinctly separated from the posterior tubercle seta by a transverse row of tubercles. The anterior seta is about twice the length of the posterior seta.

Ventrally, the tritosternum and jugularia are normal for the genus (Text-fig. 19). Sternal setae II, III and IV are situated on a rectangular shield extending from the middle of coxae II to the middle of coxae III. The anterior margin of this shield, in the majority of the specimens examined, is concave and the posterior margin convex. The geniti-ventral shield is of the usual form with two pairs of simple setae. The epigynal portion of the shield is well-developed. The interscutal membrane between the geniti-ventral and anal shields bears four pairs of setae. The four setae lying between the geniti-ventral and anal shields each lie on a platelet. The number of platelets appears to be variable. In the female figured by Schweizer (1922) and which the writer has examined, the two platelets on one side are fused. The anal shield is small and provided with three setae, of which the para-anals are situated behind the anal opening.

The gnathosoma and pedipalps are normal for the genus. A critical examination of the chelicerae could not be carried out owing to the state of preservation of the specimens.

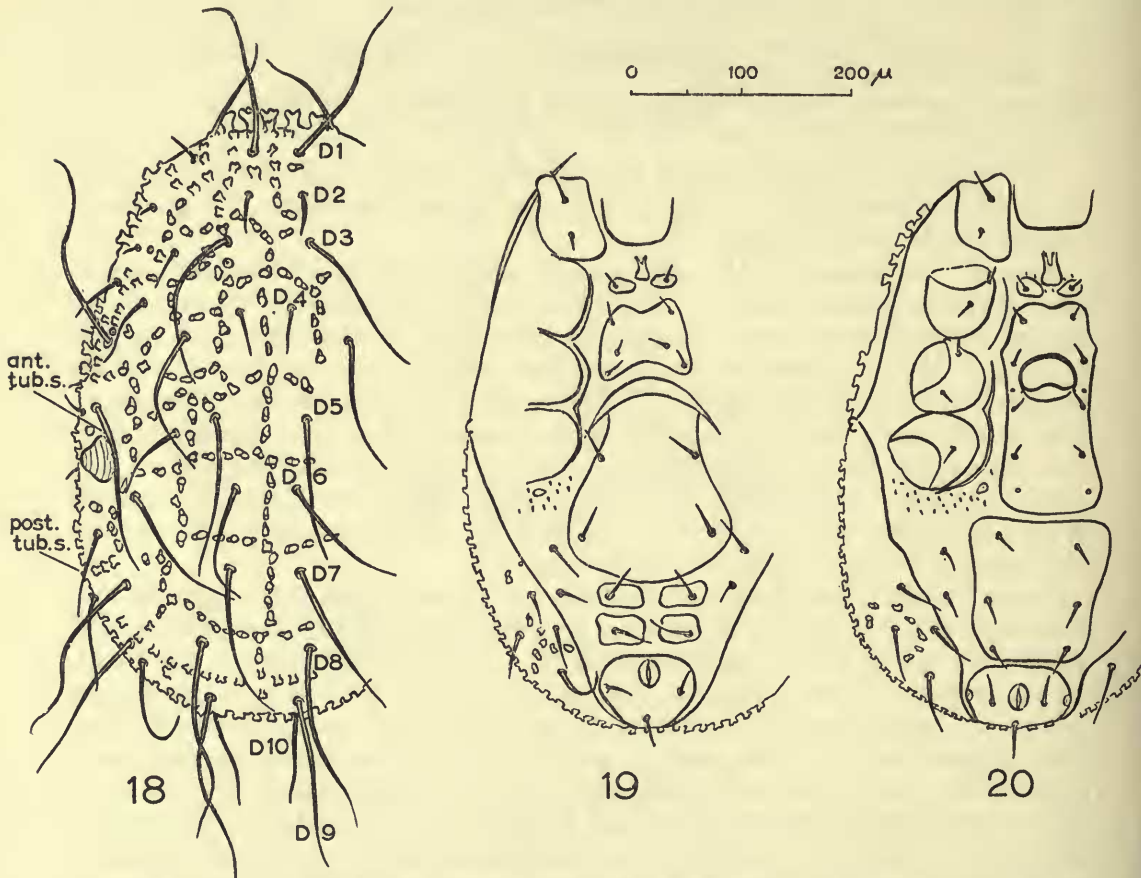
The legs are also normal for the genus. It was not possible to be certain of the number of clubbed setae on the terminal segments of the first pair of legs. As far as could be seen three clubbed were present on the tarsus.

*Male.* The ornamentation and chaetotaxy of the dorsal shield is similar to that

<sup>1</sup> Volume 12 of *Redia* was published on 25.iv.1917, but separates of Berlese's paper containing the description of this species are stated to have been published on 23.viii.1916 (see p. 177).

in the female. The chief differences between the sexes is to be seen in the structure of the ventral surface.

The elongate sterniti-genital shield, posterior to the paired jugularia, has four pairs of setae and two pairs of "pores." It extends from the middle of coxae II to beyond the posterior margin of coxae IV. The posterior margin of the shield is truncated



TEXT-FIGS. 18, 19, 20. *Epicrius canestrinii* Haller. Fig. 18, dorsum of female. Fig. 19, venter of female. Fig. 20, venter of male. *ant.tub.s.*, anterior tubercle seta; *post. tub.s.*, posterior tubercle seta.

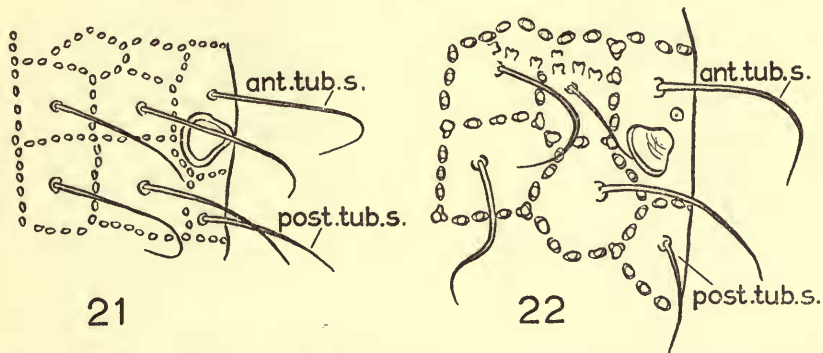
(Text-fig. 20). The region between the sterniti-genital and anal shields is occupied by large rectangular shield bearing three pairs of setae. Either side of this shield, on the interscutal membrane, are two setae. The anal shield, partly fused with the dorsal shield, is about as broad as long and has three setae and a pair of pore-like structures. The para-anals lie on the level with the posterior margin of the anal opening.

DIMENSIONS. Female : 520–550 $\mu$  in length, 340–352 $\mu$  in breadth. Male: 480–520 $\mu$  in length, 297–320 $\mu$  in breadth.



LOCALITY. The type locality is in the vicinity of Bern, Switzerland. It occurs in moss and decaying vegetable material and has subsequently been recorded from the following areas: Meudon (nr. Paris), France (Berlese, 1916); Dissenhofen and Jouxal, Switzerland (Schweizer, 1922); Porth Gwarra, Cornwall, England (Michael Coll.); and Delden, Holland and Sucy-en-Brie, France (Oudemans Coll.).

This species may be readily separated from other species of the genus by the structure and chaetotaxy of the region of the dorso-lateral protuberance. Haller (1881), in his original description of the species, deals only with the structure of the dorsum. He gives a figure of dorso-lateral protuberance and associated setae showing the separation of the posterior tubercle seta from the tubercle (Text-fig. 21). This



TEXT-FIGS. 21, 22. *Epicrius canestrinii* Haller. Ornamentation and chaetotaxy in the region of the dorso-lateral protuberance of the female. Fig. 21, after Haller (1881). Fig. 22, specimen in the Michael Collection. Abbreviations as in Fig. 18.

figure agrees very well with the one based on material examined by the writer (Text-fig. 22).

The male of *Epicrius* (*Diepicrius*) *parisiensis* Berlese agrees in all details with the male of *E. canestrinii*.

### *Epicrius menzeli* Schweizer, 1922.

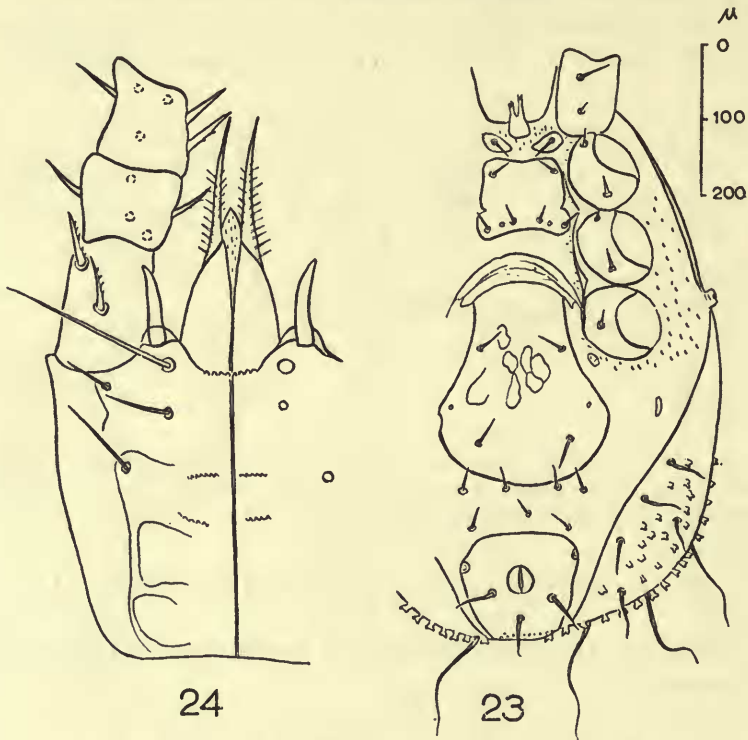
*Epicrius menzeli* Schweizer, J. Verh. Natf. Ges. Basel, 1922, 33: 47, figs. ♂ & ♀.

The following re-description of *E. menzeli* is based on the type material kindly lent to the writer by Dr. J. Schweizer, Birsfelden.

FEMALE. The dorsal shield,  $748\mu \times 451\mu$ , is provided with a network of tubercles as in other species of the genus. The tubercles are bi- and trispinate. The setae of row D are considerably more uniform in length than in the preceding species—setae D2 and D4 being approximately equal in length to D3. The dorso-lateral protuberance is strongly formed and the setae lying immediately anterior and posterior to it are contained in the same area.

Ventrally, the tritosternum is normal for the genus (Text-fig. 23). The first pair of sternal setae are situated on distinct platelets. The remainder of the sternal setae lie on a large sternal shield extending from the middle of coxae II to the middle

of coxae III. Sternal setae II are widely separated from setae III and IV, which lie in a transverse line along the posterior margin of the shield. A pair of distinct "pores" lies between setae III and IV. The geniti-ventral shield is large and flask-shaped, with two pairs of setae. The epigynal portion of the shield extends a considerable distance beyond the genital orifice. The geniti-ventral is faintly sculptured and has a pair of "pores." The interscutal membrane between the geniti-ventral and the anal shields bears seven setae arranged as in the figure. The anal



TEXT-FIGS. 23, 24. *Epicrius menzeli* Schweizer, female. Fig. 24, gnathosoma (ventral). Fig. 23, venter.

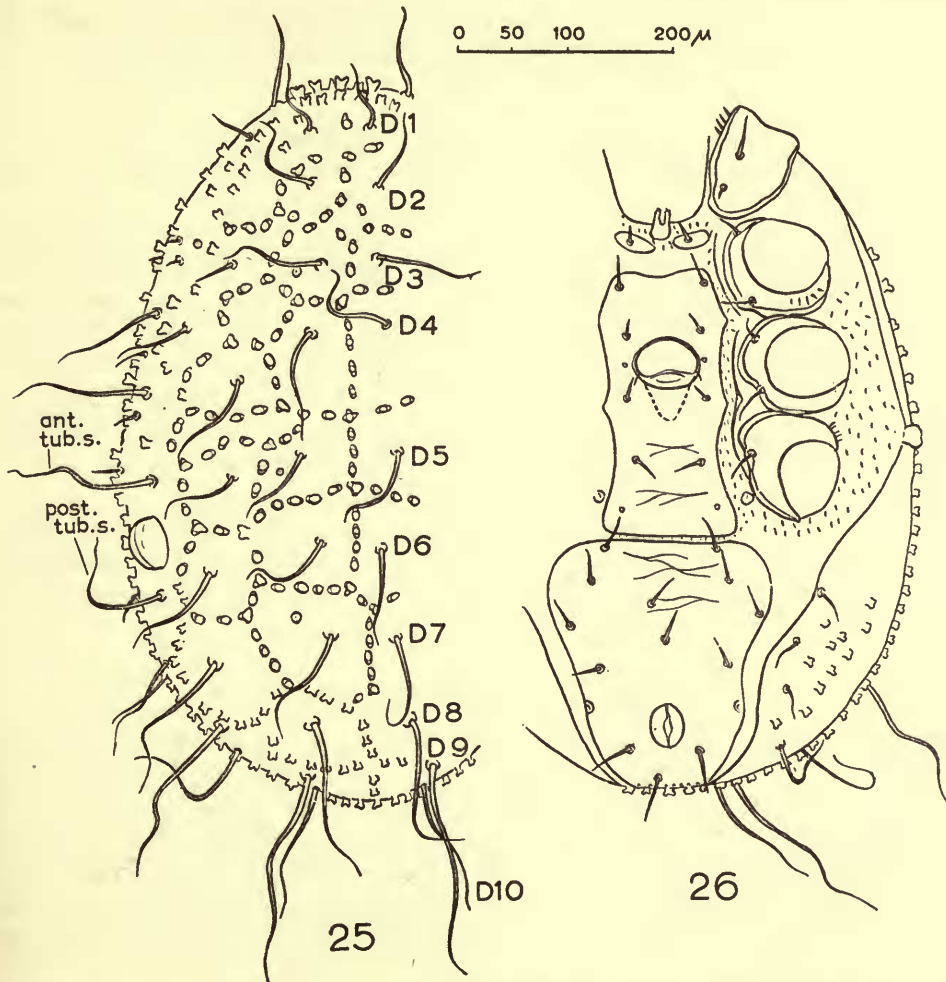
shield has three setae and a pair of large pore-like structures (muscle attachments (?)). The para-anal setae are situated posterior to the anal opening. The metapodalia are small, as are the pro-se-plates posterior to coxae IV.

The gnathosoma and pedipalps are normal for the genus (Text-fig. 24). The rostrals ( $240\mu$ ), the interior posterior rostrals ( $77\mu$ ), the exterior posterior rostrals ( $66\mu$ ) and the capitular setae ( $110\mu$ ) are distributed as in the figure. The chelicerae are chelate-dentate and normal for the genus. The legs conform in general with those in the preceding species. Tibia I (approximately  $185\mu$  in length) is provided with one clubbed seta and tarsus I (approximately  $220\mu$ ) with three clubbed setae.

MALE. The dorsal shield in this sex measures  $627-638\mu$  in length and  $418-429\mu$

in breadth. The ornamentation and chaetotaxy is basically the same as in the female (Text-fig. 25).

Ventrally, the jugularia are well-developed and widely separated from the sterniti-genital shield (Text-fig. 26). The latter has four pairs of simple setae and two pairs of "pores" distributed as in the figure. The shield is incised anteriorly and truncate



TEXT-FIGS. 25, 26. *Epicrius menzeli* Schweizer, male. Fig. 25, dorsum. Fig. 26, venter.

posteriorly. It is faintly sculptured. The genital orifice is situated between coxae III. The genital sclerites are as in other species of the genus. The region posterior to the sterniti-genital is occupied by a large ventri-anal shield bearing thirteen simple setae and a pair of conspicuous "pores". The para-anal setae lie posterior to the anal opening. The shield is faintly sculptured. The porose platelets are situated postero-lateral to coxae IV. The metapodalia are apparently absent.

The gnathosoma and pedipalps are essentially the same as in the female. The chelicerae were not fully visible in the preparations examined.

Tibia I (176–181 $\mu$  in length) is provided with one clubbed seta and tarsus I (178–198 $\mu$  in length) with three clubbed setae.

DIMENSIONS. Female: 748 $\mu$  in length, 451 $\mu$  in breadth. Male: 627–638 $\mu$  in length, 418–429 $\mu$  in breadth.

LOCALITY. The type material comprises one female and three males collected in damp Beech leaves in a ditch near Bennwil ("Basler Jura"), Switzerland.

### *Epicrius minor* Willmann, 1953

*Epicrius (Epicriella) minor* Willmann, C., Sitzber. österr. Akad. Wiss. math-nat. Kl. 1953, 1, 6: 474, fig. ♀.

This species is characterized by the structure of the sternal region of the female, the only sex known. Sternal setae II lie on the interscutal membrane between the jugularia and an elongate shield bearing setae III and IV. The geniti-ventral shield is large and flask-shaped with two pairs of setae and a pair of "pores". The interscutal membrane between the geniti-ventral and the anal shields has one pair of setae only. The anal shield bears five setae, of which the paired para-anals are situated behind the anal opening. The details of the ornamentation and chaetotaxy of the dorsal shield are not given in the original description of the species.

DIMENSIONS. Female 405 $\mu$  in length, 255 $\mu$  in breadth.

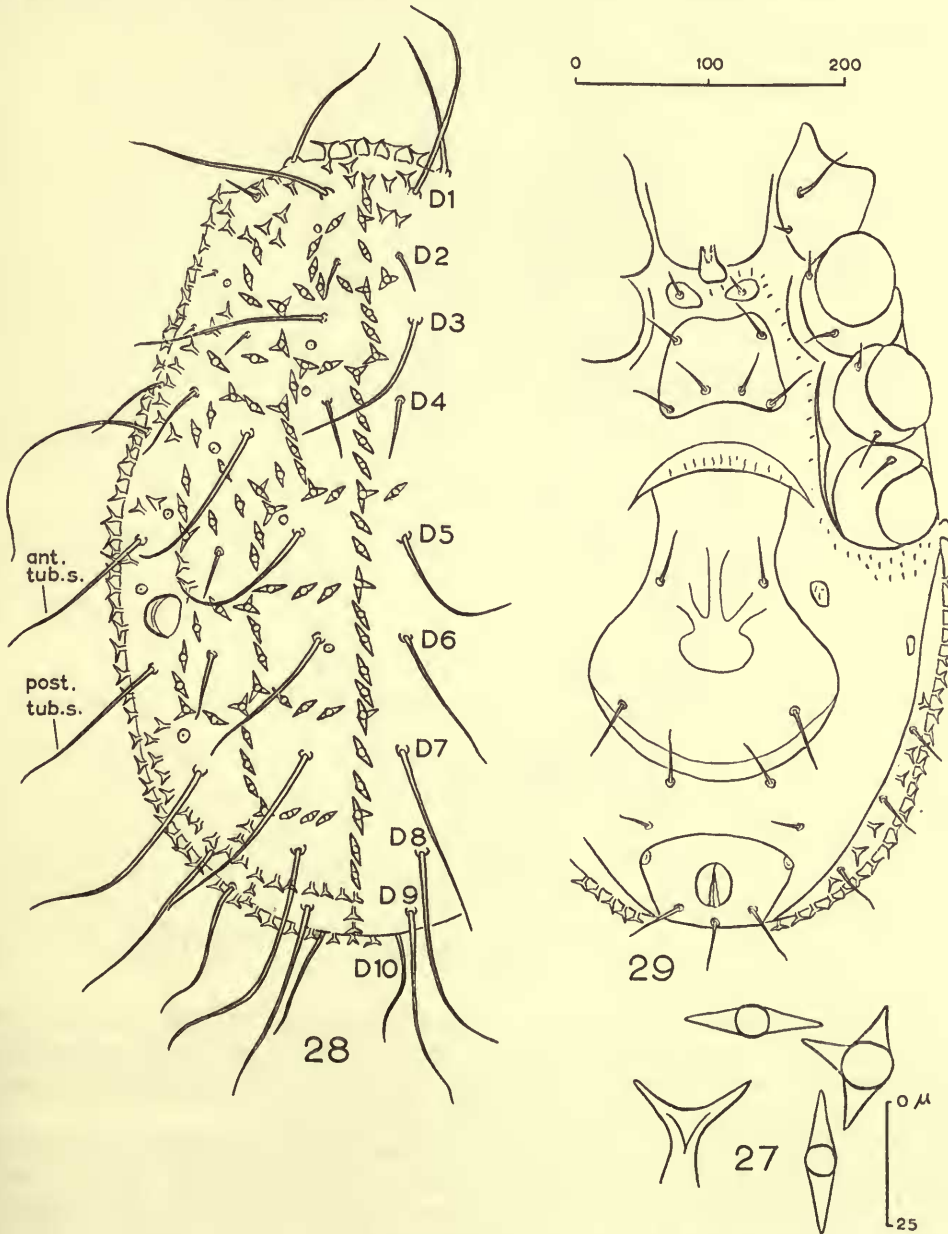
LOCALITY. "Gipel des Unterberges, etwa 1,300 m., in den Voralpen von Niederösterreich, Waldquadrat in niederem Buchenkrummholz mit zwischenstehenden jungen Fichten . . . Untervegetation bedeckt den Boden zu einem Drittel, viel Buchenfallaub. 11.vi.1939, 1 ♀" (Willmann, 1953).

### *Epicrius spinituberculatus* sp. n.

FEMALE. The dorsal shield, 594 $\mu$  in length and 396 $\mu$  in breadth, is richly provided with tubercles forming a distinct network. The structure of the tubercles is unique amongst the genus *Epicrius* in that the distal projections are sharply pointed and not obtuse as in the other species (Text-fig. 27 and Pl. II). The number of dorsal setae is normal for the genus. Setae D<sub>2</sub> and D<sub>4</sub> are considerably shorter than D<sub>3</sub>, whilst D<sub>7</sub>, D<sub>8</sub> and D<sub>9</sub> are approximately equal in length (Text-fig. 28). The dorso-lateral protuberance is well-developed and the setae lying anterior and posterior to it are contained in the same area.

Ventrally, the tritosternum is normal for the genus (Text-fig. 29). The first pair of sternal setae are situated on distinct platelets, whilst sternal setae II to IV are on a sclerotized shield extending from the middle of coxae II to the middle of coxae III. The distribution of setae II to IV is similar to that in *E. menzeli*. The geniti-ventral shield is flask-shaped, being constricted in the region of the anterior of two pairs of setae which are situated on it. The epigynal portion of the shield is similar to that in *E. mollis*. The striated interscutal membrane between the geniti-ventral and anal shields is provided with two pairs of simple setae. The anal shield is not fused

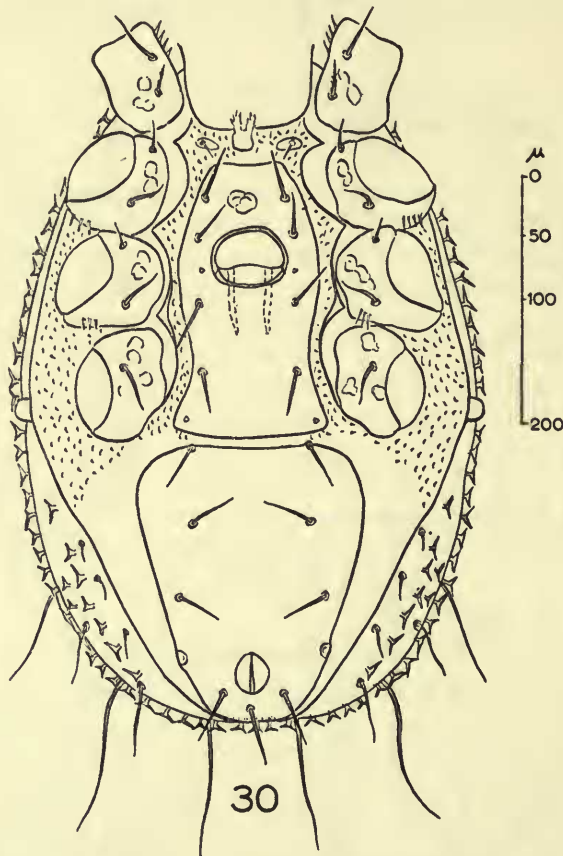
with the dorsal shield and bears three setae. The para-anals are situated behind the anal opening. A pair of large pore-like structures is present antero-laterally on the anal shield. The metapodalia and porose plates are present in the positions shown in the figure.



TEXT-FIGS. 27, 28, 29. *Epicrius spinituberculatus* sp. n., female. Fig. 27, dorsal tubercles. Fig. 28, dorsal shield. Fig. 29, venter

The gnathosoma and pedipalps are normal for the genus. The chelate-dentate chelicerae were not sufficiently exposed for critical study.

The general structure of the legs is normal for the genus. Tibia I,  $187\mu$  in length, has one clubbed seta. The number of clubbed setae on tarsus I, which is approximately equal in length to tibia I, could not be ascertained owing to the state of preservation of the specimen.



TEXT-FIG. 30. *Epicrius spinituberculatus* sp. n. Venter of male.

MALE. The network of tubercles and the relative length of setae D2-D4 on the dorsum of the male are the same as in the female. The lateral and postero-lateral setae appear to be relatively longer in length, but this may be due to the distortion of the dorsal setae in the female as the result of mounting.

Ventrally, the tritosternum and jugularia are normal for the genus. The sterni-genital shield bears four pairs of simple setae and two pairs of "pores" (Text-fig. 30). The genital orifice is situated between coxae III. The region posterior to coxae IV is occupied by a large ventri-anal shield similar in shape to that in *E. menzeli*, but having only three pairs of pre-anal setae. The para-anals are

situated posterior to the anal opening. A pair of large pore-like structures is also present on the shield. The interscutal membrane in the region of the coxae is richly provided with minute spines.

The gnathosoma and pedipalps are normal for the genus. The chelicerae are chelate-dentate.

Tibia I,  $154\mu$  in length, is provided with one clubbed seta and tarsus I,  $165\mu$  in length, has three of the four macro-setae clubbed.

DIMENSIONS: Female:  $597\mu$  in length,  $396\mu$  in breadth. Male:  $535-540\mu$  in length,  $340\mu$  in breadth.

LOCALITY: A single female (holotype, 1930.8.25.2198) labelled *Epicrius canestrinii* Haller in the Michael Collection in the British Museum (Nat. Hist.) The specimen is without a precise locality, as are the majority of Michaels' specimens. Also two males (Allotype, 1954.9.8.2 and Paratype 1954.9.8.3), collected by the writer from a thick layer of humus (F-layer) under bracken in the Leri Valley, near Dol-y-bont, Cardiganshire, Wales, on 19.iv.1954.

*E. spinituberculatus* may be readily separated from other species of the genus by the structure of the dorsal tubercles, the chaetotactic pattern of the dorsal shield, and the chaetotaxy of interscutal membrane between the geniti-ventral and anal shields in the female.

#### *Species Dubiae*

The following three species which probably belong to the genus *Epicrius*, have not been examined by the writer; the descriptions are inadequate for their certain recognition.

#### *Gamasus reticulatus* Grube, 1859

*Gamasus reticulatus*, Grube, A. E., Arch. Naturk. Liv. Ehst.-u. Kurl. 1895, (2) 1: 459 and 474.

*Epicrius reticulatus*, Oudemans, A. C., Zool. Anz. 1939, 126: 306.

The original description is sufficient only to indicate that this species probably belongs to the genus *Epicrius*. The ornamentation of the dorsal shield of the unique specimen is described as "seriebus papillarum fucarum symmetrice reticulato". The first pair of legs are without claws. The type locality is in Latvia. Grube's material may be in Dorpat or Breslau (Oudemans, 1939).

#### *Eugamasus cavernarum* Absolon, 1899

*Eugamasus cavernarum*, Absolon, Ph. C. K., Zool. Anz. 1899, 22: 324.

*Epicrius cavernarum*, Oudemans, A. C., Zool. Anz. 1939, 126: 307.

The description of this species is chiefly based on the male. The ventral surface in this sex is said to be divided into a number of plates. The sternal plate is small (or narrow) and rounded off, whilst the genital plate, connected with the anal plate behind, is prolonged and rounded off anteriorly. Further the "abdominalplatte" is divided into two distinct plates. The remainder of the description deals with

structures which are characteristic of all other species of the genus. The description of the female is too short to be of value in defining the species.

If Absolon's description of the ventral surface of the male is correct, then *E. cavernarum* is undoubtedly a valid species. The writer is inclined, however, to treat it as a *species dubia* until the type material can be re-examined.

*E. cavernarum* was found on the excreta of bats in a cave (Slouperhôle) in Moravia, Czechoslovakia.

### *Epicrius washingtonianus* Berlese, 1916

*Epicrius washingtonianus* Berlese, A., Redia, 1916, 12: 151.

Berlese opens his description of this species by stating that "species hanc describere bene non possum . . .". The description deals with the ornamentation and chaetotaxy of the dorsal shield only and is as follows:

"... Tamen a caeteris hucusque notis est diversum, quod corniculis dorso-lateralibus (ad quartos pedes) caret et areolis minus numerosis quam in *E. cirratus* gaudet. Pili dorsi (qui adhuc persistunt) breves, nulla barbula ornati, simplices, forsitan omnes intersese statura subaequales (ad  $80\mu$  long.). Tuberculi dorsi plerumque bilobi, rarius trilobi. Ad  $600\mu$  long.;  $420\mu$ . lat. Caeteris hucusque notis specibus maior.

Habitat. Inveni in muscis ad 'Washington' collectis."

### II Genus *Berlesiana* Turk, 1943

*Berlesiana* Turk, F. A., Ann. Mag. nat. Hist. 1943, (11), 10: 855.

This genus was proposed by Turk for *Epicrius cirratus* Berlese. He considered the structure of the sternal region in that species to be so distinctive that "when the types are re-examined a new family will have to be made". This would appear to be likely in the light of Trägårdh's concept of the family *Epicriidae* (Trägårdh, 1939). The discovery of a new species undoubtedly congeneric with *E. cirratus* but with sternal setae II and III in the female on an undivided shield shows that the structure of the sternum in the *Epicriidae* is more variable than Trägårdh realised, and cannot be used as a major character in the classification of the *Epicriina*.

The ornamentation of the dorsal shield and the structure of the dorsal setae in *E. cirratus* separates it from the *mollis*-group of species. The writer proposes to retain *Berlesiana* Turk as a valid genus but at the same time emending the original definition as follows:

With the general characters of the genus *Epicrius* but differing from it in the following characters: tubercles of the dorsum more numerous; posterolateral protuberance poorly developed; dorsal setae short, stout and strongly barbed; geniti-ventral shield in the female more or less parallel-sided; tarsus I with less than three pairs of clubbed setae.

Type: *Epicrius cirratus* Berl., 1916.



The genus *Berlesiana* contains two species which may be separated by the structure of the sternal shield in female, as follows :

1. Sternal setae II to IV each situated on a separate shield . . . *Berlesiana cirrata* (Berl.)  
 -. Sternal setae II and III on an undivided shield . . . *Berlesiana denticulata* sp. n.

***Berlesiana cirrata* (Berl.), 1916**

*Epicrius cirratus* Berlese, A., Redia. 1916, 12 : 151.

*Berlesiana cirratus* Turk, F. A., Ann. Mag. nat. Hist. 1943, (11) 10 : 855.

In the original description of this species Berlese mentions the ornamentation and chaetotaxy of the dorsal shield. The dorsal setae are about  $50\mu$  in length. The dorso-lateral protuberance is stated to be absent, but it is possible that Berlese may have overlooked it, since a poorly developed protuberance is present in the normal position in the species described below.

The sternal plate in the female is described as "in partes duas laterales fracto ; quaeque pars autem fissura transversa plus minusve bene in scutulis duobus rotundis, in medio piliferis divisa". The ventri-anal shield is provided with five setae in the female. The male is not described.

DIMENSIONS. Female :  $440\mu$  in length,  $300\mu$  in breadth. Male : "considerably smaller".

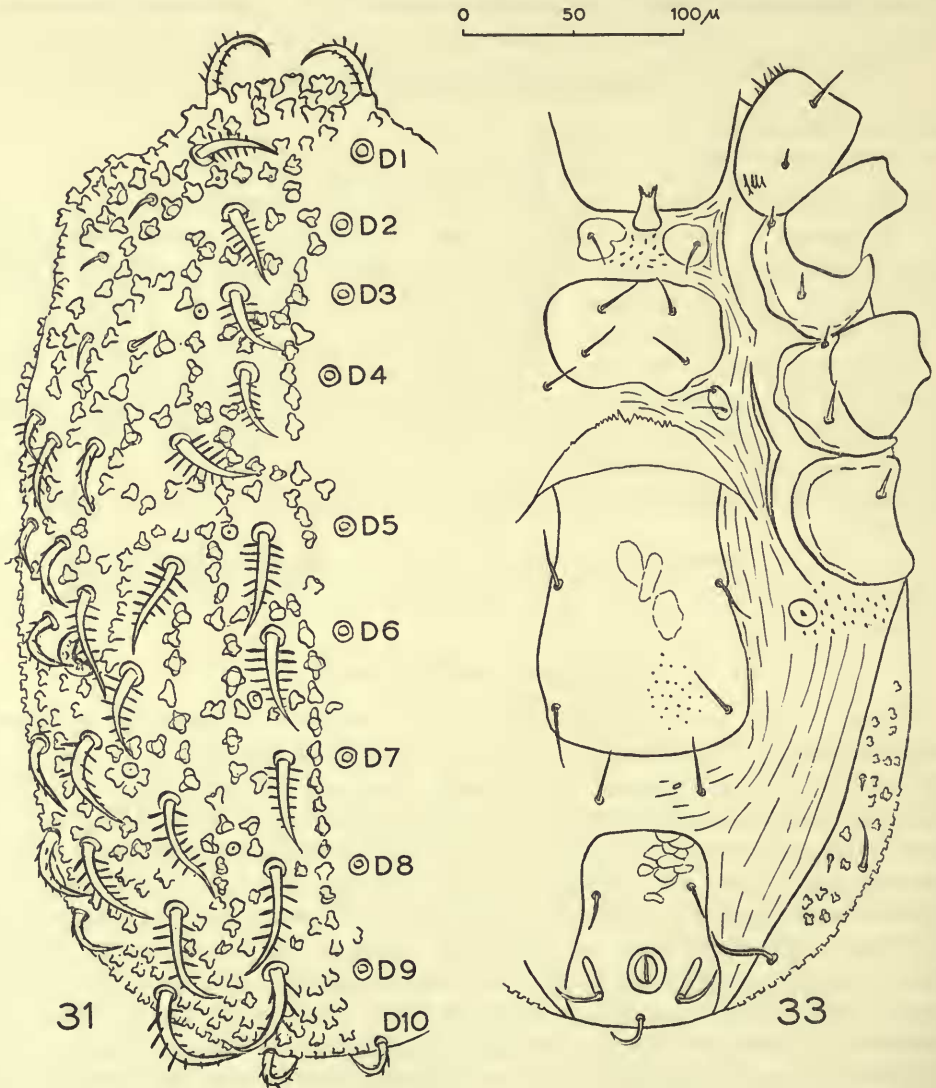
LOCALITY. This species is known from the type localities only ; the female from Chianti and Pontedera, and the male from near Genoa. In all localities the species was found in moss.

***Berlesiana denticulata* sp. n.**

FEMALE. The dorsal shield,  $415-425\mu$  in length and  $260-265\mu$  in breadth, completely covers the dorsum of the mite. The ornamentation of the shield consists of numerous tubercles, predominantly tri-lobed (Text-fig. 31). The dorso-lateral protuberance is not nearly as well developed as in the genus *Epicrius*. The dorsal setae with the exception of four pairs of simple setae antero-laterally, are short ( $44-55\mu$ ), stout and strongly barbed (Text-fig. 32). Setae D<sub>1</sub> to D<sub>10</sub> are approximately equal in length. The distribution of "pores" is shown in the figure.

Ventrally, the tritosternum and jugularia are as in the genus *Epicrius*. Sternal setae II and III are situated on an undivided shield extending from the middle of coxae II to the middle of coxae III (Text-fig. 33). Setae IV (the metasternals) lie off this shield. In the holotype the metasternal seta on one side lies on the inter-scutal membrane but on the other side there are two setae situated on a small shield. This is undoubtedly an aberration since in the paratypes sternal setae IV are situated on the interscutal membrane postero-lateral to the shield bearing setae II and III. The geniti-ventral shield is ornamented with punctations and is roughly rectangular in shape. Its posterior margin is truncated. The epigynal portion of the shield is well-developed and denticulate along its anterior margin. The geniti-ventral bears two pairs of simple setae. The endo-podal plates are poorly developed and not fused with the sternal shield. The ventri-anal shield is elongate, truncate anteriorly and

provided with a pair of pre-anal setae. The surface of the shield is scabrid. There is a tendency for increased setation of the ventri-anal. In one of the paratypes there are four pre-anal setae. The ventri-anal is not fused with the dorsal shield

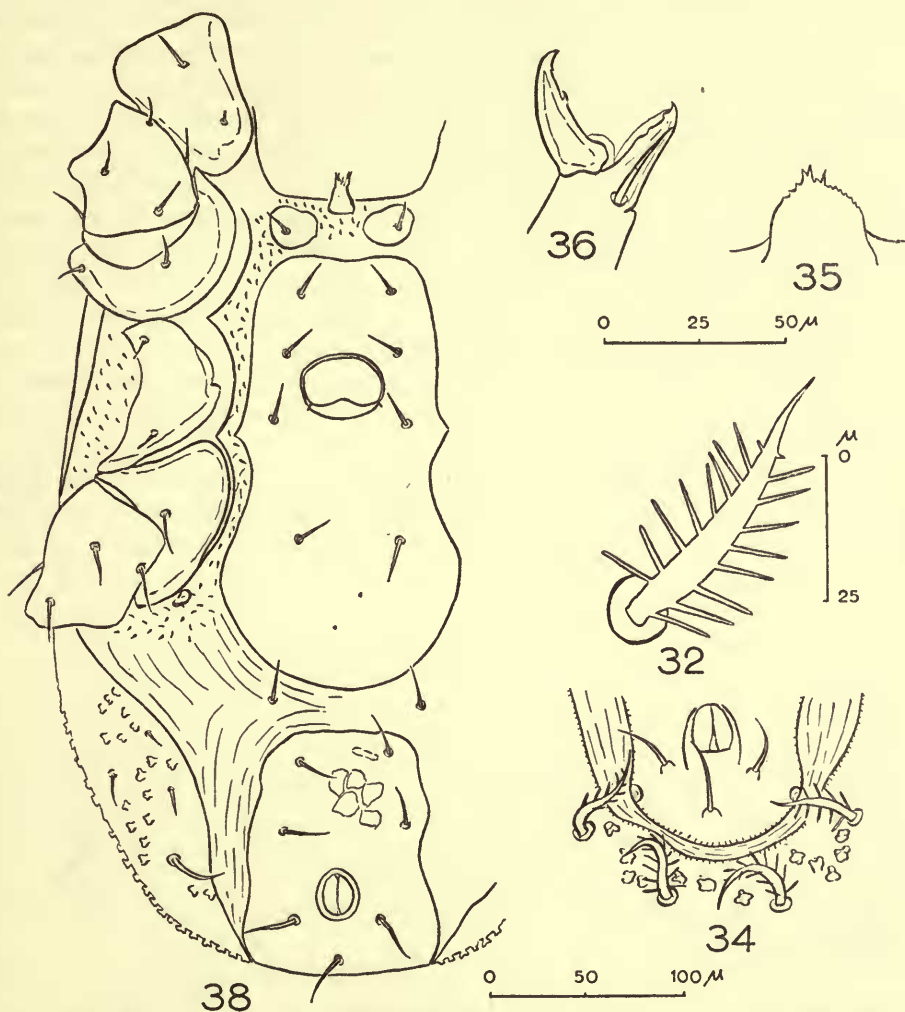


TEXT-FIGS. 31, 33. *Berlesiana denticulata* n. sp., female. Fig. 31, dorsal shield. Fig. 33, venter.

(Text-fig. 34). A pair of simple setae is present between the geniti-ventral and anal shields.

The gnathosoma is provided with four pairs of setae ventrally of which the rostrals are considerably longer than the other three pairs. The pedipalps have

five free segments. The chaetotaxy of the palptrochanter, femur and genu is (2-5-6). The palptarsus is incompletely separated from the tibia; the two segments being fused dorsally. The specialized seta on the palptarsus is three-



TEXT-FIGS. 32, 34, 35, 36, 38. *Berlesiana denticulata* n. sp. Fig. 32, dorsal seta of female. Fig. 34, postero-ventral region of female. Fig. 35, tectum of female. Fig. 36, chelicera of female. Fig. 38, venter of male.

pronged. The tectum is denticulate and basically the same as in species of *Epicrius* (Text-fig. 35). The chelicerae are chelate-dentate (Text-fig. 36).

Leg I is considerably longer than the body and is without an ambulacral apparatus. Tibia I, about  $110\mu$  in length, has no clubbed setae. The chaetotaxy of tarsus I is shown in Text-fig. 37 (p. 182). This segment has two clubbed setae and, proximally

a long stout seta lying parallel to the longitudinal axis of the segment. Legs II to IV terminate in a pulvillus and two claws, and are of the form in the genus *Epicrius*.

MALE. The ornamentation and chaetotaxy of the dorsal shield in the male is essentially similar to that of the female.

Ventrally, the jugularia are relatively large and are distinct from the sterniti-genital shield which extends from the middle of coxae II to well beyond the posterior margin of coxae IV. This compound shield bears four pairs of simple setae distributed as in Text-fig. 38. The genital orifice is situated between coxae III and its structure is normal for the family. The surface of the shield appears to be corrugated in preserved specimens. It is not strongly sclerotized. The ventri-anal shield is similar in form to that in the female except that it bears an additional pair of pre-anal setae. The striated interscutal membrane between the sterniti-genital has a pair of simple setae. There is also evidence of increased setation of the ventral shields in the male. In one specimen two short setae were present posterior to the last pair of "sternal" setae on the sterniti-genital.

The gnathosoma, pedipalps and legs are basically the same as in the female.

DIMENSIONS. Female: 415-425 $\mu$  in length, 260-265 $\mu$  in breadth. Male: 400-405 $\mu$  in length, 240-250 $\mu$  in breadth.

LOCALITY. Five females and seven males from litter under Beech at Boxhill, Surrey (collected by Messrs. S. K. Eltringham and K. H. Hyatt, 21.viii.1953). Holotype female, 1954.9.8.9; Allotype male, 1954.9.8.10; Paratypes, 1954.9.8.11-20.

#### GEOGRAPHICAL DISTRIBUTION OF THE EPICRIIDAE

Any discussion on the zoogeography of the free-living Acarina is open to criticism on the basis that very little work has been done on them outside the Palaearctic and Nearctic Regions. It is, therefore, not possible to be dogmatic about the limits of distribution of any group of free-living mites. Bearing this in mind, it can be stated that, at present, the *Epicriidae* are recorded only from the Palaearctic and Nearctic Regions; ten "species" from the former and only one species from the latter.<sup>1</sup> *Epicrius mollis* (Kr.) appears to be the most widely distributed species in the Palaearctic Region having been recorded from a number of localities between Sicily in the south and Sweden in the north.

The writer has been unable to find representatives of this family in recent collections of free-living mites from Uganda, India, Singapore and Rennell Is.

#### DISCUSSION

The examination of the above mentioned species of the genera *Epicrius* and *Berlesiana* enables one to discuss in some detail the value of the morphological characters which have formed the bases of the various classifications of the *Epicriidae* put forward by previous workers. In several of these investigations, particularly those

<sup>1</sup> Baker & Wharton (1952) state that "on Guam *Epicrius* sp. was found among the rhizomes of epiphytic ferns . . ." in which case this is the first record of the family outside the Palaearctic and Nearctic Regions.

of Trägårdh, on the comparative morphology of the *Mesostigmata*, the classification has been built up on the evidence supplied by the critical examination of only one species, *Epicrius mollis* (Kr.). The following outline of the development of the classification of the family since its erection by Berlese (1885) will serve as the basis for discussion.

Berlese (1885) considered the genus *Epicrius* and *Podocinium* Berl. to constitute a subfamily (!) *Epicriidae* of the family *Gamasidae*. The characteristic features of this subfamily were the elongate first pair of ambulatory appendages and the ornamentation of the body of the mites. *Epicrius* and *Podocinium* were separated on the degree of development of the peritreme. Later (Berlese, 1892), *Epicrius* was placed with *Zercon* Koch and *Seiodes* Berl. in the *Zerconidae*, apparently on account of the position of the genital orifice in the male. This classification was retained by Berlese (1913) in his introduction to the "Acarotheca Italica," except that the *Zerconidae* was divided into the *Zerconini* and the *Epicriini*. Vitzthum (1929, 1931 and 1941) followed, in the main, Berlese's classification and at the same time emphasized the close relationship between the *Epicriidae* and the *Zerconidae*.

Trägårdh (1938), in the first of his important contributions to the classification of the *Mesostigmata*, separated the *Epicriidae* and the *Zerconidae*; placing the former in the SEJINA (= LIROASPINA) and the latter in the GAMASINA on differences in the structure of the genital and sternal regions in the females. The *Epicriidae* was regarded as a primitive group because of the absence of a distinct epigynal shield and the segmentation of the sternal region. The *Sejidae* (= *Liroaspididae*) and *Epicriidae* were separated as follows:

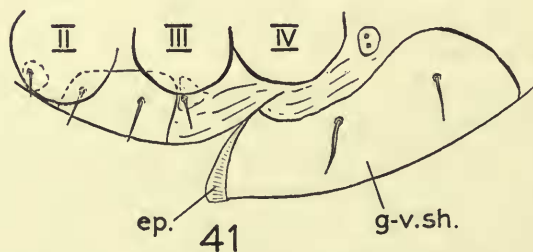
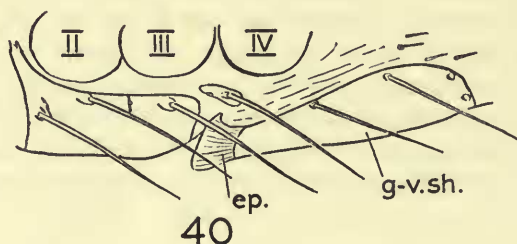
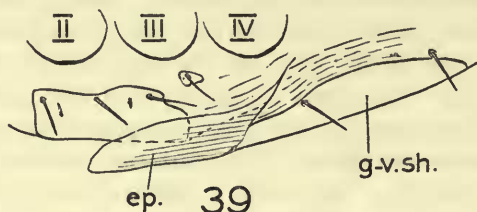
- "A. Sternal shields III and IV fused, forming a narrow transverse shield,  
separated from the remaining sternal shield . . . . . Fam. *Sejidae*.  
AA. All sternal shields fused . . . . . Fam. *Epicriidae*."

In 1946 (1946a) the same general classification of the LIROASPINA was given except that the sternal region of the *Epicriidae* was now described as "sternal shields I free, shields II-IV fused." But after examining the structure of the genital region in the male, the *Epicriidae* was removed from the LIROASPINA to the EPICRIINA (Trägårdh, 1946b). At the same time the EPICRIINA was stated to resemble the ZERCONINA in this character. Therefore, the final result of Trägårdh's researches were to separate the *Epicriidae* and the *Zerconidae* into distinct cohorts, chiefly on the structure of the genital region in the females.

The writer disagreed with Trägårdh's interpretation of the structure of the genital region in the female of the *Epicriidae* and could find no evidence for his statement that an epigynal shield is not developed in this group (Evans, 1955). The genitio-ventral shield in both *Epicrius* and *Berlesiana* are basically the same as that in the *Laelaptoidea*. This is shown in Text-figs. 39-41, where a comparison is made between the genital region of two species of Laelaptoid mites and *E. mollis*. The writer therefore, suggested the inclusion of the *Epicriidae* and *Zerconidae* in the EPICRIINA, following Vitzthum (1941).

The second important morphological character used by Trägårdh in the classification of the LIROASPINA and EPICRIINA is the structure of the sternal shield in the

females. It is on the basis of the degree of fragmentation of the sternal shield in the female that the *Epicriidae* was originally separated from the *Liroaspidae* and, later, the *Liroaspidae* from the *Epicrosejidae* (Trägårdh, 1952). This separation of the families appears to have been made after the examination of one species from each family. From the present revision of the *Epicriidae* it is quite obvious that the fragmentation of the sternal region in this group shows considerable variety and can no



TEXT-FIGS. 39-41. Lateral view of the sterniti-geniti-ventral region of the females of two species of Laelaptoid mites (Figs. 39 and 40) and *Epicrius mollis* (Kr.), (Fig. 41). *ep.*, epigynal portion of the geniti-ventral shield; *g-v.sh.*, geniti-ventral shield.

longer be used as a major character in the classification of the family. The following types of sternal "shields" were encountered in the females:

1. Sternal setae II free; III and IV on a shield, (*E. minor*).
2. Sternal setae II and III on a shield; IV free, (*E. mollis*, *B. denticulata*).
3. Sternal setae II, III and IV on a shield, (*E. canestrinii*, *E. menzeli*, *E. spinituberculatus*).
4. Sternal setae II, III and IV each on separate shield, (*B. cirrata*).

Jugularia are present in both sexes in all species.

The generic concept in the *Epicriidae* also has the structure of the sternal region in the females as its basis. In the recent classification given by Baker & Wharton (1952) the genera *Epicrius* and *Berlesiana* are placed in separate families; the former in the *Epicriidae* and the latter in the *Liroaspidae*. In the present classification both genera have been included in the *Epicriidae* and the subgenera *Diepicrius* and *Epicriella* have been relegated to the synonymy.

## SUMMARY

1. A revision is given of the family *Epicriidae* with a discussion on the classification of the EPICRIINA.

2. Two genera, *Epicrius* and *Berlesiana*, are considered valid. The former contains five valid species and three of uncertain status, and the latter two species.

3. Keys to species are given for the identification of both sexes of *Epicrius* and the females only of *Berlesiana*. *Epicrius* (*Diepicrius*) *parisiensis* Berl. is considered to be a synonym of *Epicrius canestrini* Haller.

4. The following two species are described as new: *Epicrius spinituberculatus* and *Berlesiana denticulata*.

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## EXPLANATION OF PLATES.

## PLATE 1.

Ornamentation of the dorsal shield in *Epicrius mollis* (Kramer). × 1000.

## PLATE 2.

Ornamentation of the dorsal shield in *Epicrius spinituberculatus* sp. n. × 800.



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